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RE: EVALUATION OF EXPOSURES TO AIRBORNE FIBERS

A continuing need to evaluate exposures to fibers, especially in view of the information contained in Technical Bulletin No. 85-1, Refractory Ceramic Fiber Insulating Material, suggests that some comments relating to the sampling and analysis of fibers are particularly appropriate at this time. We recommend that exposures to both asbestos and refractory ceramic fibers be evaluated by the same method, Asbestos Fibers in Air (NIOSH's P&CAM 239), the procedure that has had wide use for a number of years. A relatively new method for fibers (NIOSH 7400) using a 25 mm filter and different sampling rates shows considerable promise. A number of laboratories, including EHL, are still evaluating it. However, until some consensus is reached, we believe it advisable to stay with P&CAM 239.

Briefly, method P&CAM 239 specifies sample collection at a rate of 1-2.5 lpm on a 37 mm mixed cellulose ester membrane filter held in an open-faced cassette. Following collection, the membrane filters are cleared and the fibers are counted under phase contrast illumination at 400X magnification. Very specific rules apply to the counting procedure.

A review of asbestos samples collected in Alcoa plants over the last several months shows that a significant portion of these samples have relatively brief sampling durations, 15 to 60 minutes. The practical limit of sensitivity for a sample of 15 minutes duration is one fiber/cc. The application of samples of such short duration is most appropriate for range-finding or determining if a 10 f/cc ceiling limit is exceeded. They are not appropriate for estimating exposures of long duration, especially 8-hour TWA exposures. Whenever possible, one should measure exposures over the total duration of an operation.

If one expects to obtain a meaningful measurement of asbestos when the fiber exposures are near the Alcoa asbestos limit, 0.5 f/cc, the absolute minimum air volume to be sampled is 60 liters. This volume provides a fiber count at the limit of sensitivity and at which the accuracy of the determination is poor. Therefore, it is desirable that the sampling volume be higher, ideally 600 liters. Unless you have reason to suspect high fiber concentrations, these sampling volume recommendations also should be observed when evaluating exposures for which no previous sampling data exists.

Because of the higher permissible exposure limit for refractory ceramic fibers, meaningful evaluations of exposure to this material can be accomplished from samples of lesser volumes than would be required for asbestos evaluations. The absolute minimum sample volume required to evaluate refractory ceramic fiber exposures near the exposure limit, 2 f/cc, is 15 liters. The ideal sampling volume is 150 liters.

If it is necessary to determine an 8-hour TWA from an operation of short duration, it is essential that the minimum sampling volumes cited above be observed. If the duration of the operation is too short to enable collection of sufficient volume, it will be necessary to sample two or more repetitions of the operation on the same filter until the optimum volume has been achieved.

Samples of long duration (several hours) have the potential to present a different problem. Large volume samples, especially those from environments that are highly contaminated, are more likely to overload the filter with fibers and dust particles making an accurate fiber count difficult. When an overload of the filter is likely, it is advisable to take two or more samples over the duration of the operation to be sampled.

If prior sampling results are available, estimated concentrations based on these results can be used to determine the optimum sample duration. For accurate counting, an ideal concentration of total fibers collected on the filter is such that there will be about one fiber in each 0.003 mm^2 counting field. Using the value of one fiber per counting field, the optimum sample volume in liters calculates to be:

$$285 \div \text{estimated concentration, f/cc}$$

Samples for fiber exposure evaluation should be sent to EHL for fiber count analysis. Normally, fiber samples will be analyzed within one week following receipt of the sample. Should you have any questions about fiber sampling or counting, or if you would like to have a copy of P&CAM 239, please contact Richard Milito, at EHL.

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